Docket No.: O3020.0342/P342
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BOARD OF PATENT APPEALS AND INTERFERENCES

In re Patent Application of:
Masanobu Okada

Confirmation No.: 8902

Application No.: 10/625,654

Art Unit: 2876

Filed: July 24, 2003

Examiner: K.C. Koyama

For: CARD READER AND TRANSACTION PROCESSING APPARATUS

APPEAL BRIEF

U.S. Patent and Trademark Office
Customer Window, Mail Stop Appeal Brief - Patents
Randolph Building
Alexandria, VA 22314

Dear Sir:

This is an Appeal Brief pursuant to 35 U.S.C. § 134 and 37 C.F.R. §§ 41.31 et seq. from the final rejection of claims 1-9 of the above-identified application. The Notice of Appeal was filed on March 30, 2005. The fee for submitting this Brief in accordance with 37 C.F.R. § 1.17(c) is attached. Any deficiency in the fees associated with this Brief should be charged to Deposit Account No. 04-1073.

I. REAL PARTY IN INTEREST

The real party in interest in this appeal is OMRON Corporation, a corporation organized under and pursuant to the laws of Japan, and the assignee of this application.

II. RELATED APPEALS AND INTERFERENCES

There are no other known appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

A. Current Status of Claims

Canceled	None
Withdrawn	None
Pending	1-9
Allowed	None
Rejected	1-9

B. Claims on Appeal

The claims on appeal are claims 1-9.

IV. STATUS OF AMENDMENTS

A final Office Action was mailed December 2, 2004. Appellant filed a Request for Reconsideration on March 1, 2005. An Advisory Action was mailed March 24, 2005. Appellant filed a Notice of Appeal on March 30, 2005. No amendments have been submitted subsequent to the December 2, 2004 final Office Action.

A complete listing of the claims on appeal appears in Appendix A.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claims 1, 5, 6, 8 and 9 are pending.

Independent claim 1 is directed to a card reader. Referring to Figs. 1 and 2 (reproduced on the following page), the card reader of claim 1 comprises, *inter alia,* a card entrance 21; a readout head 9 for reading information recorded on a card 20 inserted at the card entrance 21; an output circuit 10 for outputting information read by the readout head 9; a card conveyance mechanism 25 for discharging the card; and an ultrasonic wave sensor 2 for detecting whether a card is present outside the card entrance when the card 20 is discharged by the card conveyance mechanism 25.

FIG. 1

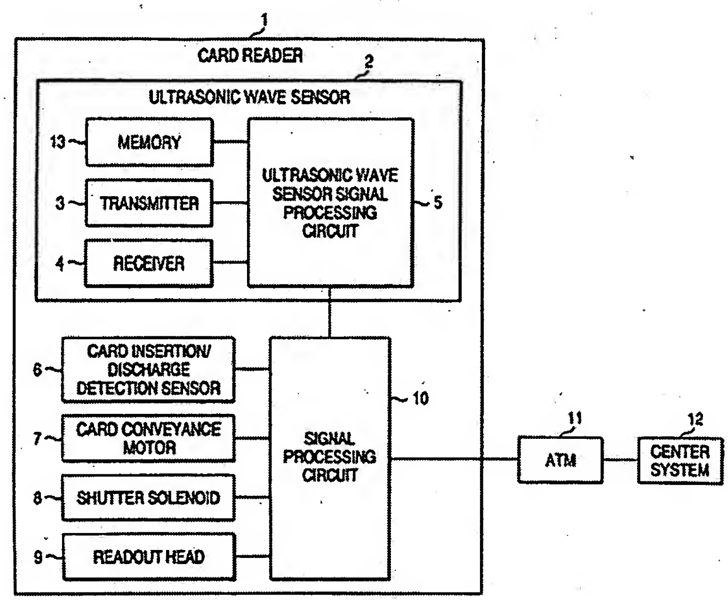
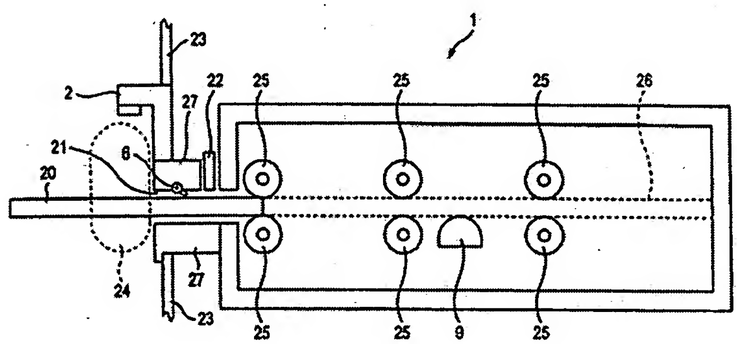


FIG. 2



When a foreign body, for example, a false card reader, is mounted on the legitimate card reader 1 in a detection range 24, the sensor 2 cannot detect the presence of the discharged card 20 because of interference from the foreign body. The sensor can then send an alert signal indicating the presence of a foreign body. In claim 1, the sensor 2 is an ultrasonic wave sensor. Even in situations where a foreign body can avoid direct detection, for example, by absorbing ultrasonic waves, the sensor 2 will still be unable to

detect the discharged card 20, in this case because of the absorption of the waves, and will thus become aware of the presence of a foreign body and generate an alert signal.

Claim 1 therefore recites an "*ultrasonic wave sensor* for *detecting whether a card is present* outside the card entrance when the card is discharged" (emphasis added).

Independent claim 5 is directed to a card reader 1. Referring again to Figs. 1 and 2, the card reader of claim 5 comprises, *inter alia,* a card entrance 21; a readout head 9 for reading information recorded on a card 20 inserted at the card entrance 21; an output circuit 10 for outputting information read by the readout head 9; a card conveyance mechanism 25 for discharging the card 20; an ultrasonic wave sensor 2 comprising a transmitter 3 to transmit ultrasonic waves outside the card entrance 21 and a receiver 4 to receive reflected waves of ultrasonic waves from a body when the body is present at the card entrance 21; a memory 13 for storing, as a reference duration, a necessary duration from transmission of ultrasonic waves to reception in the case where a card 21 is present outside the card entrance 21; and an abnormality determination unit 5 to make a comparison between said necessary duration at the time of reception of ultrasonic waves transmitted from the transmitter 3 when the card conveyance mechanism 25 discharges the card 20 and the reference duration stored in the memory 13, and to output the presence or absence of an abnormality on the basis of results of the comparison.

Here, the claim 5 reader 1 is configured to detect a body present at a card entrance 21 by comparing a measured necessary duration and a reference duration using an abnormality detection unit. The necessary duration is the duration between transmission and reception of ultrasonic waves measured by a sensor 2. The reference duration stored in memory 13 is the expected duration between transmission and

reception of ultrasonic waves when a card 20 is present at the card entrance 21. If the durations do not match, the abnormality detection unit 5 can then indicate an abnormality.

Claim 5 therefore recites "an *ultrasonic wave sensor* comprising a transmitter to transmit ultrasonic waves outside the card entrance and a receiver to receive reflected waves of ultrasonic waves from a body when the body is present *at the card entrance*" and "*an abnormality determination unit* to make a *comparison between the necessary duration* at the time of reception of ultrasonic waves transmitted from the transmitter when the card conveyance mechanism discharges the card *and the reference duration* stored in the memory" (emphasis added).

Claim 6 is directed to a card reader 1. Referring again to Figs. 1 and 2, the card reader 1 of claim 6 comprises, inter alia, a card entrance 21; a readout head 9 for reading information recorded on a card 20 inserted at the card entrance 21; an output circuit 10 for outputting information read by the readout head 9; a card conveyance mechanism 25 for discharging the card; and a sensor 2 for detecting whether an object is present outside the card entrance 21; wherein the sensor 2 detects whether a foreign body is present as said object at a time of standby for card processing and stores a reference value, and the sensor 2 detects whether the card 20 is present as said object when the card conveyance mechanism 25 discharges the card 20 by comparing a discharge value to said reference value.

Here, a sensor 2 (not necessarily an ultrasonic wave sensor) detects whether an object is present outside a card entrance 21. The sensor 2 both detects whether a foreign object is present at a time of standby, storing a reference value, and *also* detects whether a card 20 is present when the conveyance mechanism 25 discharges the card by comparing a

discharge value to the reference value, thereby distinguishing between a discharged card and other foreign bodies.

Claim 6 therefore recites a "*sensor* for detecting whether an object is present *outside the card entrance*" which "detects *whether the card is present as said object* . . . by comparing a discharge value to [a] reference value" (emphasis added).

Claim 8 relates to a transaction processing apparatus. Referring again to Figs. 1 and 2, the apparatus of claim 8 comprises, *inter alia*, a card entrance 21; a readout head 9 for reading information recorded on a card 20 inserted at the card entrance 21; an output circuit 10 for outputting information read by the readout head 9; a transaction processing unit 11 for performing a transaction processing on the basis of information from the output circuit 10; a card conveyance mechanism 25 for discharging the card 20 in the case where the transaction processing unit 11 completes transaction; and an ultrasonic wave sensor 2 for detecting whether the card 20 is present outside the card entrance 21 when the card 20 is discharged by the card conveyance mechanism 25.

As discussed above with respect to claim 1, claim 8 likewise recites an "*ultrasonic wave sensor* for *detecting whether a card is present* outside the card entrance when the card is discharged" (emphasis added).

Claim 9 relates to a transaction processing apparatus. Referring again to Figs. 1 and 2, the apparatus of claim 9 comprises, *inter alia*, a card entrance 21; a readout head 9 for reading information recorded on a card 20 inserted at the card entrance 21; an output circuit 10 for outputting information read by the readout head 9; a transaction processing unit 11 for performing a transaction processing on the basis of information from the output

circuit 10; a card conveyance mechanism 25 for discharging the card 20 when the transaction processing unit 11 completes a transaction; and an ultrasonic wave sensor 2 for detecting whether the card 20 is present outside the card entrance 21 when the card 20 is discharged by the card conveyance mechanism 25, said ultrasonic wave sensor 2 comprises a transmitter 3 for transmitting an ultrasonic signal, a receiver 4 for receiving a reflection signal of said ultrasonic signal, a reference duration memory 13 and an ultrasonic wave sensor signal processing circuit 5 which uses said reflection signal and information in said memory 5 to determine if said card 20 is outside said card entrance 21.

Claim 9 likewise recites an "*ultrasonic wave sensor* for *detecting whether a card is present* outside the card entrance when the card is discharged" (emphasis added).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The rejection of claims 1-9 under 35 U.S.C. 103(a) as being unpatentable over Nagata (U.S. Patent No. 6,629,643) (Attached as Exhibit 1) in view of Okano (JPO11-153666) (Attached as Exhibits 2 and 3) and Furuya (U.S. Patent No. 6,164,538) (Attached as Exhibit 4).

VII. ARGUMENT

A. CLAIMS 1- 9 ARE PATENTABLE OVER NAGATA (U.S. PATENT NO. 6,629,643) IN VIEW OF OKANO (JPO11-153666) AND FURUYA(U.S. PATENT NO. 6,164,538)

As discussed below, the Final Rejection has failed to establish a *prima facie* case of unpatentability with respect to claims 1-9.

For convenience, Figs. 1 and 2 of the application are reproduced below. See also Section V of this Brief. As previously discussed above in Section V above, Figs. 1 and 2 illustrate a transaction processing apparatus comprising a card reader 1 which has an ultrasonic wave sensor 2 for detecting the presence of a card 20 outside a card reader opening 21. When a foreign body, for example, a false card reader is mounted on the card reader 1 in a detection range 24, the ultrasonic wave sensor 2 cannot detect the presence of the discharged card 20 because of interference from the foreign body. The comparison by the sensor 2 between the stored reference value and the discharge value indicates whether a foreign body is present in a detection range 24, even in cases where the foreign body interferes with the sensor's ability to detect the foreign body directly, for example by absorbing ultrasonic waves. The sensor 2 can then send an alert signal indicating the presence of a foreign body.

FIG. 1

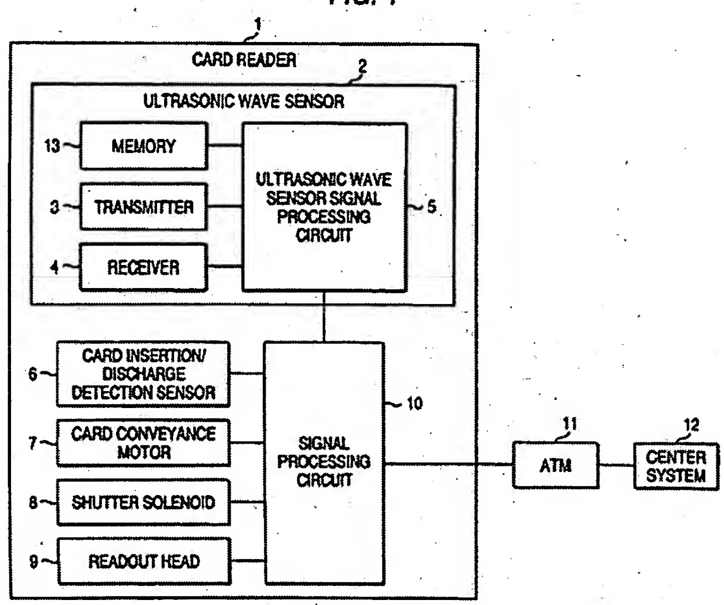
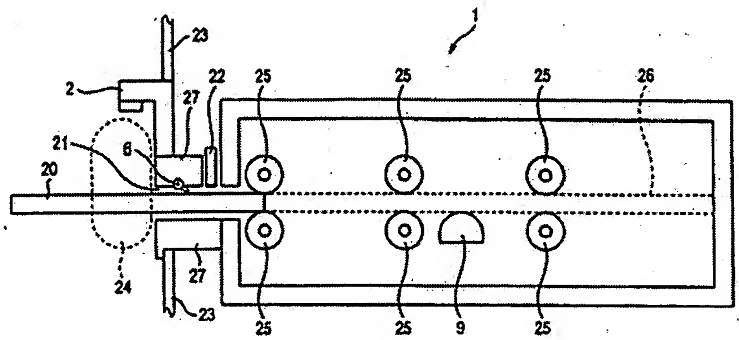


FIG. 2



Each one of independent claims 1, 8 and 9 require an "*ultrasonic wave sensor* for *detecting whether a card is present* outside the card entrance when the card is discharged" (emphasis added). Independent claim 5 recites "an *ultrasonic wave sensor* comprising a transmitter to transmit ultrasonic waves outside the card entrance and a receiver to receive reflected waves of ultrasonic waves from a body when the body is present *at the card entrance*" and "*an abnormality determination unit* to make a *comparison between the necessary duration* at the time of reception of ultrasonic waves transmitted from the transmitter when the card conveyance mechanism discharges the card *and the reference duration* stored in the memory" (emphasis added). Claim 6 recites a "*sensor* for detecting whether an object is present *outside the card entrance*" which "detects *whether the card is present as said object . . .* by comparing a discharge value to [a] reference value" (emphasis added).

Appellant respectfully submits that Nagata, Okano and Furuya, alone or in combination, do not disclose, teach or suggest the above recited elements of the claims.

1. <u>There is no teaching, suggestion, or motivation, in Okano or elsewhere, to substitute the sensor of Nagata with an ultrasonic wave sensor as required by independent claims 1, 8 and 9.</u>

   a. <u>Nagata teaches away from using an ultrasonic wave sensor in place of magnetic head 20 because to do so would result in an inoperable device.</u>

Nagata is directed to a magnetic card transaction apparatus. The Final Rejection cites Fig. 1, which illustrates a schematic configuration of the preferred embodiment of Nagata. Fig. 1 from Nagata is reproduced below.

Fig. 1

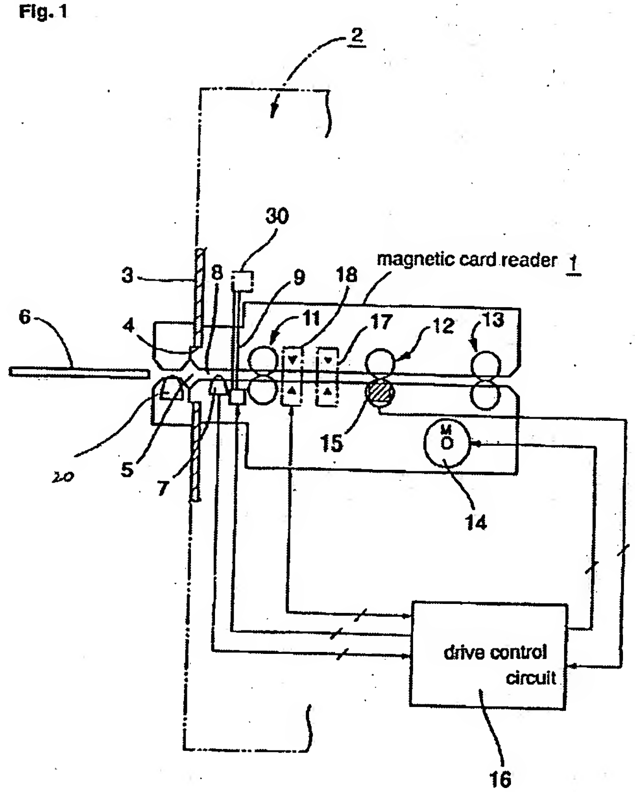


Fig. 1 of Nagata shows a schematic configuration of a magnetic card reader 1 comprising, inter alia, a card slot 5 for guiding a card 6 into a guiding path 8. A magnetic

head 7 inside the slot 5 detects the card 6 after it has been inserted and activates a shutter 9 which controls access to the guiding path 8. Rollers 11 draw the card 6 into the card reader 1, where another magnetic head 15 reads the card information. Fig. 1 also shows an illegal card reader apparatus mounted to the front of the legitimate card reader 1 and having a magnetic head 20 for illegally reading the card information as the card 6 passes through the illegal card reader into and out of the legitimate card reader 1.

The Final Rejection states at page 2 that "Nagata shows a magnetic head 20 located outside of the slot 5," which "acts as a detector for detecting magnetic cards, which is considered a sensor for detecting whether a card is present outside the card entrance 11."

The card reader 1 of Nagata, however, does *not* include magnetic head 20. As described above, magnetic head 20 is part of a separate, illegal card reader apparatus which is attached to the front of the legitimate card reader apparatus 1. To the extent that the illegal magnetic head 20 comprises a sensor for detecting whether a card is present outside legitimate card reader entrance 5, which it does not, the primary function of the magnetic head 20 is to perform the illegal reading of card 6 information.

As the Final Rejection admits at page 2, "Nagata fails to teach an ultrasonic wave sensor." The Final Rejection goes on to state that it would have been obvious to "integrate the teachings of Okano to the teachings of Nagata in order to determine whether a card is discharged in a proper manner for the user to receive his/her card from the card reader, and also ensures the safety of the reader from inappropriate objects from entering the reader." Appellant respectfully submits that these teachings are not found in Nagata or Okano, but in Appellant's own specification.

Magnetic head 20 is the only element of Nagata that is capable of detecting a card 6 outside a card slot. Any proposed modification of this magnetic head must be viewed in light of the magnetic head's primary purpose, i.e., theft of card information. To replace the illegal magnetic head 20, which simply reads a discharged card, with an ultrasonic sensor, which only detects a discharged card and is incapable of reading card information, would thus destroy the primary function of the magnetic head 20 and make the illegal card reader inoperable. As the Federal Circuit has held, a modification that produces a "seemingly inoperable device" necessarily teaches away from that modification. McGinley v. Franklin Sports, Inc., 262 F.3d 1339, 1354 (Fed. Cir. 2001), citing In re Sponnoble, 405 F.2d 578, 587 (CCPA 1969). Furthermore, "references that teach away [from a particular combination] cannot serve to create a prima facie case of obviousness." McGinley, 262 F.3d at 1353-4, citing In re Gurley, 27 F.3d 551, 553 (Fed. Cir. 1994).

Accordingly, there is no teaching in Nagata, Okano or elsewhere of detecting a card outside a card slot with an ultrasonic wave sensor to "determine whether a card is discharged in a proper manner" or to "ensure[] the safety of the reader," as the Final Office Action alleges.

b. Okano is not analogous art.

Okano is drawn to a system of preventing interference among proximal ultrasonic sensors. Okano is not drawn to a card reader and does not disclose a "sensor for detecting whether a card is present outside the card entrance" of a card reader.

Instead, Okano is primarily concerned with the prevention of interference among an array of ultrasonic wave sensors in a large scale setting, such as detecting cars in

a parking lot. See Okano, ¶ 2 (Exhibit 2; machine translation attached as Exhibit 3). The Final Rejection presents no evidence supporting ultrasonic wave sensors used in a card reader setting.

The present invention employs an ultrasonic wave sensor in a much more confined area 24 and is not directed to interference with other ultrasonic wave sensors. The Final Rejection does not explain why a person of ordinary skill in the art would look to this unrelated reference for a teaching concerning the detection of a card outside a card slot, or for use of that detection to detect the presence of a fraudulent card reader.

c. Neither Nagata nor Okano disclose a clear and particular motivation to combine an ultrasonic sensor with the card reader of Nagata.

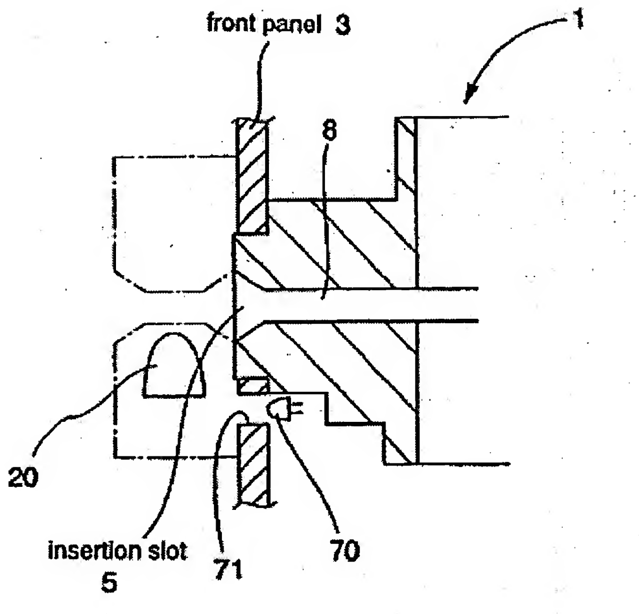
"The showing of motivation to combine must be clear and particular, and it must be supported by actual evidence." Teleflex, Inc. v. Ficosa North America Corp., 299 F.3d 1313, 1334 (Fed. Cir. 2002), citing In re Dembiczak, , 175 F.3d 994, 999 (Fed. Cir. 1999). "Broad, conclusory statements regarding the teaching of the multiple references, standing alone, are not 'evidence.'" In re Dembiczak, 175 F.3d at 999.

As the Final Rejection admits at page 2, "Nagata fails to teach an ultrasonic wave sensor." The Final Rejection relies on Okano, a nonanalogous reference, for the disclosure of an ultrasonic wave sensor, but neither reference discloses any reason to replace the magnetic head 20 of Nagata with an ultrasonic wave sensor. Indeed, as noted earlier, replacing the illegal magnetic head 20 of Nagata with an ultrasonic wave sensor would render the illegal card reader inoperable. The Final Rejection merely recites the capabilities of the ultrasonic wave sensor of Okano and declares that "it would have been

obvious to integrate the teachings of Okano to the teachings of Nagata in order to determine whether a card is discharged in a proper manner for the user to receive his/her card from the card reader, and also ensures the safety of the reader from inappropriate objects from entering the reader" at page 3. The mere disclosure of an ultrasonic wave sensor in an unrelated field of endeavor, however, does not support the Final Rejection's broad, conclusory statement of obviousness.

Regarding claim 2, the Final Rejection states at page 4 that "one of the embodiments of Nagata's invention shows a detector 70 that is an optical reflective sensor that detects a foreign object on the front surface (col. 5, lines 45-50)." Figure 7 of Nagata is reproduced below. The Final Rejection then states, without evidence, that it would have been obvious to modify Nagata "to detect non magnetic card objects such that the card reader can prevent non magnetic card objects from entering the reader." Again, there is no teaching, suggestion or motivation in Nagata to prevent objects from entering the card slot. The sensor 70 of Nagata is designed to detect an illegal card reader blocking an opening 70 *below* the card slot 5. The sensor 70 of Nagata is not capable of detecting "card objects such that the card reader can prevent non-magnetic card objects from entering the reader" because the optical sensor is outside of the line of sight of the card entrance 5 and Nagata discloses no alternative embodiments that disclose detection of an object outside the card entrance.

Fig. 7



The Advisory Action mailed March 24, 2005, states that "the Examiner believes that both references teach sensors and such commonality provides motivation for one [of] ordinary skill in the art to combine the two references together." Appellant respectfully submits that this is also not the correct standard. The Federal Circuit requires a showing of motivation to combine to be "clear and particular" and supported by "actual evidence." Teleflex, 299 F.3d at 1334.

d. The Final Rejection relies on improper hindsight in combining the references.

Rather than present evidence of motivation to combine, the Final Rejection uses Appellant's specification as a roadmap for combining Nagata and Okano. Because "[t]he genius of invention is often a combination of known elements which in hindsight seems preordained," the Federal Circuit requires a "rigorous application of the requirement for a

showing of the teaching or motivation to combine prior art references." McGinley, 262 F.3d at 1351; In re Dembiczak, 175 F.3d at 999.

To properly combine references, "particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed." In re Kotzab, 217 F.3d 1365 (Fed. Cir. 2000). Neither Nagata, nor Okano discuss the desirability of detecting the presence or absence of a card outside the card slot of a card reader using an ultrasonic wave sensor. Instead, the Final Rejection recites motivation and teachings for combining Nagata and Okano found only in Appellant's specification.

The Final Rejection relies on Furuya for the disclosure of data output only. Furuya does not disclose, teach or suggest the detection of a card outside a card entrance, by ultrasonic wave sensor or otherwise, and the Final Rejection does not allege that it does.

Thus, the cited references, alone or in combination, fail to render claims 1, 8 and 9 obvious. Claims 2-4 are dependent on independent claim 1 and are allowable along with claim 1. Therefore, for at least the above reasons, Claims 1-4, 8 and 9 should be allowed over the prior art of record.

2. Claim 5

Independent claim 5 recites "an *ultrasonic wave sensor* comprising a transmitter to transmit ultrasonic waves outside the card entrance and a receiver to receive reflected waves of ultrasonic waves from a body when the body is present *at the card entrance*" and "*an abnormality determination unit* to make a *comparison between the necessary duration* at the time of reception of ultrasonic waves transmitted from the transmitter when the card

conveyance mechanism discharges the card *and the reference duration* stored in the memory" (emphasis added).

As discussed above, none of the cited references show any sensor for detecting whether a body is present at the card entrance. Further, as discussed above, there is no motivation in Okano or elsewhere to combine an ultrasonic wave sensor with the card reader of Nagata.

Additionally, the ultrasonic wave sensor of claim 5 comprises "a transmitter to transmit ultrasonic waves outside the card entrance and a receiver to receive reflected waves of ultrasonic waves from a body when the body is present at the card entrance." None of Nagata, Okano and Furuya disclose, teach or suggest this combination.

For at least these reasons, claim 5 should be allowed over the prior art of record.

3. Claims 6 and 7

Independent claim 6 recites a "*sensor* for detecting whether an object is present *outside the card entrance*" which "detects *whether the card is present as said object* . . . by comparing a discharge value to [a] reference value" (emphasis added).

The deficiencies of Nagata regarding detection of a card outside a card entrance have been discussed above with respect to claims 1-4, 8 and 9. Okano and Furuya do not cure those deficiencies.

Nagata also does not disclose, teach or suggest detecting a card outside a card entrance by comparing a discharge value to a reference value. There is no discussion Nagata on the method of detection employed by illegal magnetic head 20.

Claim 7 further recites that "when the card conveyance mechanism discharges the card, an abnormality signal is output in the case where the sensor does not detect the presence of a card. To the extent that the illegal magnetic head 20 detects a card outside the card entrance 5, there is no disclosure, teaching or suggestion that either the legitimate card reader 1 or the illegal card reader will output an abnormality signal when the magnetic head 20 does not detect the presence of a card. There is no reason for an illegal card reader to output an abnormality signal if its magnetic head 20 does not detect a card, and since there is no interaction between the illegal card reader and the legitimate card reader 1, there is no way for the legitimate card reader 1 to know whether the illegal magnetic head 20 detects a card or not.

Okano and Furuya do not contain any motivation, teaching or suggestion to cure these deficiencies. For at least these reasons, claim 6 and 7 should be allowed over the prior art of record.

VIII. CONCLUSION

For the reasons given above it is respectfully submitted that the final rejection of claims 1-9 is improper. Accordingly, Appellant requests reversal of all rejections by this honorable Board.

Dated: May 31, 2005

Respectfully submitted,

By____________________

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APPENDIX A - CLAIMS

1. A card reader comprising:

a card entrance;

a readout head for reading information recorded on a card inserted at the card entrance;

an output circuit for outputting information read by the readout head;

a card conveyance mechanism for discharging the card; and

an ultrasonic wave sensor for detecting whether a card is present outside the card entrance when the card is discharged by the card conveyance mechanism.

2. The card reader according to claim 1, wherein the ultrasonic wave sensor further detects whether a foreign body is present outside the card entrance.

3. The card reader according to claim 1, wherein a reflection type sensor is used in place of the ultrasonic wave sensor.

4. The card reader according to claim 1, wherein paths of transmission and reception of ultrasonic waves, along which ultrasonic waves are transmitted toward a surface of the card from a transmitter of the ultrasonic wave sensor, reflected by the surface of the card and received by a receiver, are substantially parallel to a surface of the card entrance.

5. A card reader comprising:

a card entrance;

a readout head for reading information recorded on a card inserted at the card entrance;

an output circuit for outputting information read by the readout head;

a card conveyance mechanism for discharging the card;

an ultrasonic wave sensor comprising a transmitter to transmit ultrasonic waves outside the card entrance and a receiver to receive reflected waves of ultrasonic waves from a body when the body is present at the card entrance;

a memory for storing as a reference duration a necessary duration from transmission of ultrasonic waves to reception in the case where a card is present outside the card entrance; and

an abnormality determination unit to make a comparison between said necessary duration at the time of reception of ultrasonic waves transmitted from the transmitter when the card conveyance mechanism discharges the card and the reference duration stored in the memory, and to output presence or absence of an abnormality on the basis of results of the comparison.

6. A card reader comprising:

a card entrance;

a readout head for reading information recorded on a card inserted at the card entrance;

an output circuit for outputting information read by the readout head;

a card conveyance mechanism for discharging the card; and

a sensor for detecting whether an object is present outside the card entrance;

wherein the sensor detects whether a foreign body is present as said object at a time of standby for card processing and stores a reference value, and

the sensor detects whether the card is present as said object when the card conveyance mechanism discharges the card by comparing a discharge value to said reference value.

7. The card reader according to claim 6, wherein at the time of standby for card processing, an abnormality signal is output in the case where the sensor detects the presence of a foreign body; and

when the card conveyance mechanism discharges the card, an abnormality signal is output in the case where the sensor does not detect the presence of a card.

8. A transaction processing apparatus comprising:

a card entrance;

a readout head for reading information recorded on a card inserted at the card entrance;

an output circuit for outputting information read by the readout head;

a transaction processing unit for performing a transaction processing on the basis of information from the output circuit;

a card conveyance mechanism for discharging the card in the case where the transaction processing unit completes transaction; and

an ultrasonic wave sensor for detecting whether the card is present outside the card entrance when the card is discharged by the card conveyance mechanism.

9. A transaction processing apparatus comprising:

a card entrance;

a readout head for reading information recorded on a card inserted at the card entrance;

an output circuit for outputting information read by the readout head;

a transaction processing unit for performing a transaction processing on the basis of information from the output circuit;

a card conveyance mechanism for discharging the card when the transaction processing unit completes a transaction; and

an ultrasonic wave sensor for detecting whether the card is present outside the card entrance when the card is discharged by the card conveyance mechanism, said ultrasonic wave sensor comprises a transmitter for transmitting an ultrasonic signal, a receiver for receiving a reflection signal of said ultrasonic signal, a reference duration memory and an ultrasonic wave sensor signal processing circuit which uses said reflection signal and information in said memory to determine if said card is outside said card entrance.

APPENDIX B – EVIDENCE

Exhibit 1: U.S. Pat. No 6,629,643 to Nagata

Exhibit 2: Japanese Pat. No. JPO11-153666 to Okano

Exhibit 3: Machine Translation of Japanese Pat. No. JPO11-153666 to Okano

Exhibit 4: U.S. Pat. No. 6,164,538 to Furuya

PAT-NO: JP411153666A

DOCUMENT-IDENTIFIER: JP 11153666 A

TITLE: PREVENTION METHOD FOR ERRONEOUS DETECTION OF ULTRASONIC SENSOR

PUBN-DATE: June 8, 1999

INVENTOR-INFORMATION:

NAME	COUNTRY
OKANO, MUNENORI	N/A

ASSIGNEE-INFORMATION:

NAME	COUNTRY
HOTORON:KK	N/A

APPL-NO: JP09336533

APPL-DATE: November 20, 1997

INT-CL (IPC): G01S007/524, G01S015/10

ABSTRACT:

PROBLEM TO BE SOLVED: To prevent mutual interference of each ultrasonic sensor arranged in the vicinity without depending on timing control of ultrasonic oscillation by synchronous lines and data communication.

SOLUTION: When emitting ultrasonic wave repeatedly from an ultrasonic wave transmission element of each ultrasonic sensor 1 toward a monitoring region and receiving reflection wave appearing in a specific monitoring period from the time of ultrasonic wave emission using an ultrasonic wave reception element 20 at each time, the ultrasonic wave emission interval is made irregular for each ultrasonic wave sensor 1 and the reflection wave received in the monitoring

period is stored in memory means (frame memory) 23 in turn. Based on a plurality of reflection wave data stored in the memory means 23, the existence of an object in the monitoring region is detected.

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号

特開平11－153666

(43)公開日　平成11年(1999)６月８日

(51)Int.Cl.⁶	識別記号	ＦＩ	
Ｇ０１Ｓ　7/524		Ｇ０１Ｓ　7/52	Ｒ
15/10		15/10	

審査請求　未請求　請求項の数５　ＦＤ　（全 ８ 頁）

(21)出願番号　特願平9－336533

(22)出願日　平成９年(1997)11月20日

特許法第30条第３項適用申請有り　平成９年５月27日～５月30日　株式会社日刊工業新聞社主催の「テクノピア'97東京（オートテック）」に出品

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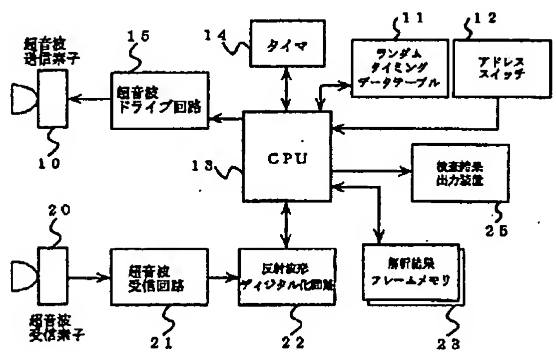
(54)【発明の名称】　超音波センサの誤検出防止方法

(57)【要約】

【課題】　同期線やデータ通信による超音波発振タイミング制御によることなく、近隣に配置された各超音波センサ間の相互干渉を防止する。

【解決手段】　各超音波センサ１の超音波送信素子１０から監視領域に向けて繰り返し超音波を発射し、そのつど超音波受信素子２０にてその超音波発射時点から所定の監視期間内に現れる反射波を受信するにあたって、各超音波センサ１ごとにその超音波発射間隔を不規則とするとともに、監視期間内に受信された反射波を記憶手段（フレームメモリ）２３に順次記憶し、同記憶手段２３に記憶された複数の反射波データに基づいて監視領域内の物体の有無を検出する。



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【特許請求の範囲】

【請求項1】　近隣に配置された複数の超音波センサ同士の相互干渉による誤検出を防止する超音波センサの誤検出防止方法において、上記各超音波センサの超音波送信素子から監視領域に向けて繰り返し超音波を発射し、そのつど超音波受信素子にてその超音波発射時点から所定の監視期間内に現れる反射波を受信するにあたって、上記各超音波センサごとにその超音波発射間隔を不規則とするとともに、上記監視期間内に受信された反射波を記憶手段に順次記憶し、同記憶手段に記憶された複数の反射波データに基づいて上記監視領域内の物体の有無を検出することを特徴とする超音波センサの誤検出防止方法。

【請求項2】　上記記憶手段内の複数の反射波データに基づいて上記監視領域内の物体の有無を検出するにあたって、各反射波データが同一である場合にはそれら反射波データを有効とし、非同一の場合には他の超音波センサからの反射波が含まれていると判定することを特徴とする請求項1に記載の超音波センサの誤検出防止方法。

【請求項3】　上記記憶手段はフレームメモリからなるとともに、上記反射波データは波形として同フレームメモリに保存され、その波形同士の対比により、他の超音波センサからの反射波が含まれているか否かを判定することを特徴とする請求項2に記載の超音波センサの誤検出防止方法。

【請求項4】　上記各超音波センサごとに、その超音波発射間隔を不規則とするランダムタイミング生成手段を備え、同ランダムタイミング生成手段には、上記各超音波センサに割り当てられるアドレスと、そのアドレスに対応して設定された複数回にわたる不規則的な超音波発射間隔データを有するタイムテーブルとが設けられており、同タイムテーブルに基づいて超音波発射間隔が制御されることを特徴とする請求項1または2に記載の超音波センサの誤検出防止方法。

【請求項5】　上記各超音波センサの基本周期は同一とされ、その基本周期内において超音波発射間隔が不規則とされることを特徴とする請求項1，2または4に記載の超音波センサの誤検出防止方法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は超音波センサの誤検出防止方法に関し、さらに詳しく言えば、近隣に配置された複数の超音波センサ同士の相互干渉による誤検出を防止する超音波センサの誤検出防止方法に関するものである。

【0002】

【従来の技術】超音波センサは比較的安価であることから、種々の物体検知センサに用いられているが、例えば駐車場における車両検知センサとして適用される場合には、各駐車エリア単位でその天井部分などに配置される。すなわち、1エリアを1つのセンサで監視することになる。

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【0003】超音波は弾性波であるため、上記のように、複数の超音波センサを近隣に配置した場合、その反射波が自己で発射したものなのか、近隣のセンサから発射されたものであるかの区別が困難であり、相互干渉による誤検知の問題が生ずる。

【0004】この問題を解決するため、従来より様々な対策が講じられているが、そのいずれも基本的には、自己の超音波と他者の超音波とを時間的に区別するようにしており、次にその3例を紹介する。

【0005】第1の方法は、例えば2つの超音波センサが近接して配置されているとして、一方の超音波センサからは時間Ｔａ秒ごとに超音波を発射させ、これに対して、他方の超音波センサＢからはそれとは異なる時間Ｔｂ秒ごとに超音波を発射させる。

【0006】そして、一方超音波センサにおいては、その受信した反射波の間隔が自己が送信した周期Ｔａ秒に一致していれば自己の送信によるものであると判断する。他方の超音波センサについても同様に、その受信した反射波の間隔が自己が送信した周期Ｔｂ秒に一致していれば自己の送信によるものであると判断する。

【0007】第2の方法は、各超音波センサに超音波発射周期の周期表を持たせ、その周期表にしたがって超音波を発射させる。そして、反射波の受信間隔がその周期表と一致していれば、自己で送信したものであると判断する。この方法においては、さらに自他の区別をより明確化にするため、少なくとも一度反射波が自己の送信によるものであることを確認できた後に、発射周期表を変更する場合もある。

【0008】第3の方法として、近隣の各超音波センサを同期線にて接続して、その各超音波センサから超音波を同時に発射させる方法がある。このように、全ての超音波センサから一斉に超音波を発射をさせることにより、近隣センサからの超音波が検出される可能性が低くなる。

【0009】

【発明が解決しようとする課題】しかしながら、第1の方法では超音波発射間隔とその反射波受信間隔とが一致しているかどうかを時間的に検証する手段が不可欠であり、それをハードウェア的もしくはソフトウェア的に行なうにしても、システム全体として複雑化を招くことになる。

【0010】第2の方法においては、近隣のセンサが同一の周期もしくは周期表で動作した場合、反射波の自他の区別が不可能になる。また、この周期は一般にセンサの物体検出応答速度に直接関係するため、周期をいたずらに変更することは好ましいことではない。

【0011】第3の方法は各超音波センサを同時に動作させるだけでよく、制御的にはもっとも簡単ではある

が、多くの超音波センサ間に同期線を引き回すことが必要であり、その工事に難が伴なう。また、この方法では発振後の監視期間も全てのセンサで同一となるため、検出すべき物体の位置によっては干渉が発生することがある。

【００１２】本発明は、このような従来の諸問題を解決するためになされたもので、その目的は、各超音波センサを同期線などにて接続することなく、また、ハードウェア的にもソフトウェア的にも比較的簡単な構成で、各超音波センサ間の相互干渉を防止することができるようにした超音波センサの誤検出防止方法を提供することにある。

【００１３】

【課題を解決するための手段】上記目的を達成するため、本発明は、近隣に配置された複数の超音波センサ同士の相互干渉による誤検出を防止する超音波センサの誤検出防止方法において、上記各超音波センサの超音波送信素子から監視領域に向けて繰り返し超音波を発射し、そのつど超音波受信素子にてその超音波発射時点から所定の監視期間内に現れる反射波を受信するにあたって、上記各超音波センサごとにその超音波発射間隔を不規則とするとともに、上記監視期間内に受信された反射波を記憶手段に順次記憶し、同記憶手段に記憶された複数の反射波データに基づいて上記監視領域内の物体の有無を検出することを特徴としている。

【００１４】このように、各超音波センサごとにその超音波発射間隔を不規則、すなわちランダムとすることにより、これに応じて反射波監視期間も不規則になるため、その反射波監視期間内に他の超音波センサからの超音波を連続的に受信する確率がきわめて低くなる。

【００１５】仮に、その反射波監視期間内に他の超音波センサからの超音波を受信したとしても、本発明では、今回受信した反射波データのみでなく、例えばその前回、前々回などの過去に受信した反射波データを含めて物体の有無を検出するようにしているため、相互干渉を排除することができる。

【００１６】すなわち、本来検出すべき反射物（静止物体）からの反射波は超音波発射タイミングがいかなる状態でも、その発射時刻から計測して同じ時間的位置に現れることになる。したがって、記憶手段内の複数の反射波データに基づいて監視領域内の物体の有無を検出するにあたって、各反射波データが同一である場合にはそれら反射波データを有効とし、非同一の場合には他の超音波センサからの反射波が含まれていると判定することができる。

【００１７】その場合において、記憶手段をフレームメモリとし、同フレームメモリに各反射波データを反射波形として保存して、その反射波形同士を対比することにより、他の超音波センサからの反射波が含まれているかどうかを簡単かつ正確に判定することができる。

【００１８】本発明においては、各超音波センサごとに、その超音波発射間隔を不規則とするランダムタイミング生成手段を備える。このランダムタイミング生成手段には、各超音波センサに割り当てられるアドレスと、そのアドレスに対応して設定された複数回にわたる不規則的な超音波発射間隔を有するタイムテーブルが設けられている。各超音波センサごとに異なるアドレスが設定され、これにより各超音波センサは、その設定された自己アドレスに基づいてそれぞれ異なった不規則な発振を繰り返すことになる。

【００１９】また、各超音波センサの基本周期を同一とし、その基本周期内において超音波発射間隔を不規則とすることが好ましく、これによれば、各超音波センサの物体検出応答速度を、精度上問題とされない程度のばらつき内に押さえ込むことができる。

【００２０】

【発明の実施の形態】次に、本発明の技術的思想をよりよく理解するうえで、図面を参照しながら、その実施例について説明する。

【００２１】図１は本発明で使用される超音波センサ１のブロック図で、その用途が例えば駐車場の車両検知センサである場合、その各駐車エリアごとに、これと同一構成の超音波センサ１がそれぞれ設けられることになる。

【００２２】説明の便宜上、この超音波センサ１は超音波送信素子１０を含む送信系と、超音波受信素子２０を含む受信系とに分けられる。

【００２３】送信系には、超音波送信素子１０から不規則的（ランダム）に超音波を発射させるためのランダムタイミングデータテーブル１１が設けられている。このランダムタイミングデータテーブル１１には、図２に示すようなデータテーブルがあらかじめ設定されている。

【００２４】すなわち、このデータテーブルは、左欄縦行に所定数のアドレス番号１，２…をとり、横列を超音波発射回数順（１回目、２回目、３回目…）としたタイムテーブルであり、そのアドレス番号ごとに超音波発射回数順に沿って、前回発射時（もしくは基準時）から何ミリ秒後に超音波を発射させるかのデータが書き込まれている。

【００２５】この超音波発射時間データは、アドレス間および超音波発射回数順のいずれにも規則性を持たないデータであり、この意味において、例えば乱数を用いて設定することが好ましい。

【００２６】このデータテーブルのアドレスは、ユーザーにより、各超音波センサ１に設けられているアドレススイッチ１２を介して適宜選択される。すなわち、アドレススイッチ１２にて自己のアドレスが例えばアドレス１に設定されると、中央演算処理ユニット（ＣＰＵ）１３により、アドレス１のタイムテーブルが読み出され、タイマ１４にセットされる。

【0027】このタイムテーブルによれば、第1回目の発振タイミングは２００ミリ秒であるため、発振するまでの待ち時間が２００ミリ秒とされる。第2回目の発振待ち時間は３５０ミリ秒であり、このようにしてn回発振した後、第1回目の発振タイミングに戻る。

【0028】このようにして、ＣＰＵ１３にて読み出された超音波発射時間データは、超音波ドライブ回路１５に与えられ、そのタイミングにしたがって超音波送信素子１０が駆動される。

【0029】受信系において、超音波受信素子２０にて受信された反射波は、その反射波受信回路２１を介して反射波形ディジタル化回路２２に与えられる。この実施例において、反射波形ディジタル化回路２２は検波回路およびＡ／Ｄ変換回路を有し、例えばその検波回路にて反射波から図３（ａ）のような検波波形を得、次にこの検波波形をＡ／Ｄ変換して同図（ｂ）のようなディジタルの反射波形とする。

【0030】ちなみに、図３（ａ）の検波波形において、右側の大きなピーク波形は床面からのものであるが、左側の小さなピーク波形は検出物体（この実施例では車両）もしくは相互干渉のいずれかによるものである。なお、Ａ／Ｄ変換回路の代わりにコンパレータを用い、反射波の検波波形を適当なしきい値をもってオン、オフのディジタル情報として反射波形を抽出するようにしてもよい。

【0031】上記のように、反射波形ディジタル化回路２２にてＡ／Ｄ変換された反射波形は、フレームメモリ２３に保存（セーブ）される。この場合、受信系おける反射波の監視期間タイミング、すなわち反射波形のディジタル化は、ＣＰＵ１３による送信系への超音波発射指示後、タイマ１４を利用してその実行が指示され、これにより反射波の時間軸長が一定に制御される。

【0032】すなわち、反射波形のディジタル化は、送信系と一定の同期をもって行なわれ、ディジタル化処理の終了も時間的に一定に制御される。このようにして、超音波送信素子１０から超音波が発射されるたびに、その発射時点から一定時間を反射波監視期間として、反射波形を得ることができる。

【0033】図4に、隣接配置された２つの超音波センサ１Ａ，１Ｂの超音波発射タイミングとその反射波監視期間との関係を例示する。同図のように、一方の超音波センサ１Ａの超音波発射間隔ＴＡ１，ＴＡ２，ＴＡ３…は図２のデータテーブルの例えばアドレス番号1によるものであり、また、他方の超音波センサ１Ｂの超音波発射間隔ＴＢ１，ＴＢ２，ＴＢ３…は同データテーブルの例えばアドレス番号2によるもので、その発射間隔はそれぞれランダムであるが、反射波監視期間ＲＷは常に一定とされる。

【0034】また、フレームメモリ２３への反射波データの書き込みもＣＰＵ１３によって行なわれる。すなわち、ＣＰＵ１３は上記のように送信系と一定の同期をもってディジタル化された反射波形を１フレームデータとして順次フレームメモリ２３に保存する。このようにして、複数回にわたる反射波形がセーブされる。

【0035】本発明においては、フレームメモリ２３にセーブされた反射波形に基づいて、その中に相互干渉による反射波が含まれているかどうかを判断する。この実施例では、ＣＰＵ１３にその判断機能を持たせているが、これをハードウェア的に処理する場合には、別途にフレームメモリ解析回路などを設けて、フレームメモリデータを演算させるようにすればよい。

【0036】図5はフレームメモリ２３に保存された過去３回分の反射波形のイメージ図である。なお、この実施例において、反射波形は本来ディジタル波形であるが、説明の便宜上、アナログ波形として示されている。

【0037】フレームメモリの解析にあたっては、例えばこの過去３回分の反射波形、すなわち最新（今回）の受信反射波形Ｗ１、前回の受信反射波形Ｗ２および前々回の受信反射波形Ｗ３をその波形同士で比較する。

【0038】この例において、反射ピーク波形Ｐ１は床面からのもので、各反射波形Ｗ１～Ｗ３ともに同じ位置に現れている。これに対して、最新の受信反射波形Ｗ１には反射ピーク波形Ｐ１の左側に別の反射ピーク波形Ｐ２が出ている。

【0039】この反射ピーク波形Ｐ２が駐車している車両などの移動しない物体によるものであれば、超音波発射間隔がミリ秒単位であるため、前回の受信反射波形Ｗ２および前々回の受信反射波形Ｗ３にも同じ位置に反射ピーク波形Ｐ２が現れるはずであるが、この例では反射波形Ｗ２，Ｗ３にはそれが存在しない。

【0040】したがって、このような場合には、反射ピーク波形Ｐ２は相互干渉による可能性が高いと判断される。なお、この実施例では過去３回分の反射波形を比較しているが、これは一種のフィルタ操作であり、解析するための比較対象とする反射波形の数は任意である。

【0041】また、相互干渉による反射波形に上記のようにフィルタをかけるには、各反射波形間における波形的な論理積をとるか、もしくは加算平均をとるなどの方法が例示できる。

【0042】一方、駐車エリアに車両が存在する場合には、図5の例で言えば、各反射波形Ｗ１～Ｗ３のすべてに、図6に示すように床面からの反射ピーク波形Ｐ１とともに、その左側に駐車車両による反射ピーク波形Ｐ３が現れることになる。ここで、左側とは床面よりも時間的に早く反射波が帰ってくることであり、床面とセンサとの間に反射物があることを意味している。

【0043】このようにして、物体が検知されると、その結果が出力回路２５に与えられる。この出力回路２５は、超音波センサに搭載されたリレーやＬＥＤ（発光ダイオード）であってよい。

【0044】この反射ピーク波形Ｐ３は例えばしきい値レベルＬとの関係で検出されるが、この場合には、そのしきい値レベルＬは車両の天井面からの反射などを基準として適宜設定されることになる。

【0045】反射ピーク波形Ｐ３は床面よりも高い所、すなわちセンサに近い所からの反射によるものであるため、時間的に床面からの反射ピーク波形Ｐ１よりも超音波受信素子２０に速く到達する。

【0046】検出物体の有無は、基本的には反射波がしきい値レベルＬを超えた場合を「有り」、超えない場合を「無し」と判断する。したがって、床面からの反射ピーク波形Ｐ１を検出物としないために、この実施例では、図６に示されているように、所定の時間幅Ｔｔｈでしきい値を解除している。

【0047】次に、各超音波センサ１に基本周期を設定し、その基本周期内で超音波をランダムに発射させる場合を別の実施例として、図７の動作フローチャートおよび図８の発信、受信のタイミングチャートを加えてより詳しく説明する。

【0048】まず、ステップＳＴ１においてＣＰＵ１３を含むこの超音波センサ１の制御系の初期化が行なわれた後、ステップＳＴ２でＣＰＵ１３により基本周期ＴＯが設定される。この例では基本周期ＴＯは７５０ミリ秒に設定され、この基本周期ＴＯ内で必ず１回超音波が発射されるようにする。

【0049】この基本周期ＴＯはすべての超音波センサ１について共通に設定され、これにより超音波センサ１の超音波発振から、その反射波受信、フィルタリング動作および物体検知に至るまでの検出時間が確保される。

【0050】次に、ステップＳＴ３において、ＣＰＵ１３はアドレススイッチ１２からユーザーにて設定された自己アドレスを得る。なお、この自己アドレスの指定は、近隣に設置される超音波センサとの関係において、超音波発射タイミングが異なるように、あらかじめユーザーによって設定される。

【0051】このようにして、自己アドレスが指定されると、各超音波センサ１はステップＳＴ４において、そのアドレス番号に属するタイムテーブルから、超音波発射回数順に設定されている超音波発射待ち時間データを読み出し、そのデータに基づいて超音波送信素子１０より超音波を発射する。

【0052】この動作を図２のデータテーブルおよび図８のタイミングチャートを参照しながら、超音波センサ１Ａを代表として説明する。超音波センサ１Ａがアドレススイッチ１２より例えばアドレス番号１を取得したとすると、ステップＳＴ４において、まず、１回目の発射タイミングデータＴＡ１として２００ミリ秒を得る。

【0053】ステップＳＴ５で基本周期ＴＯの初期時点から２００ミリ秒経過するまで待った後、ステップＳＴ６で超音波を送出する。すなわち、メイン処理の先頭から２００ミリ秒後に超音波送信素子１０から監視エリアに向けて超音波が発射される。

【0054】そして、ステップＳＴ７で監視エリアからの反射波を受信し、反射波形ディジタル化回路２２で反射波形を得た後、ステップＳＴ８でその反射波形をフレームメモリ２３に保存する。

【0055】続いて、ステップＳＴ９で過去数回の反射波形との対比により、相互干渉によるノイズのフィルタリングを行なうのであるが、この場合、超音波の発射回数が１回目であるから、ステップＳＴ１０およびステップＳＴ１１をジャンプして、ステップＳＴ１２で基本周期であるＴＯ時間が経過するまで待った後、ステップＳＴ４に戻る。この基本周期ＴＯ時間を待つことにより、超音波センサの応答スピードを一定の誤差内に納めることができる。

【0056】そして、ステップＳＴ４でデータテーブルから２回目の発射タイミングデータＴＡ２として３５０ミリ秒を得る。すると、今回はメイン処理の先頭から３５０ミリ秒後に超音波を発射する。このようにして、超音波送信素子１０から監視エリアに向けて各基本周期ＴＯの初期時点から異なった発射タイミングＴＡ１，ＴＡ２…で超音波を順次発射する。

【0057】これにより、その超音波発射ごとにフレームメモリ２３にその各反射波形が保存され、２回目以降においては、ステップＳＴ９で過去数回の反射波形との対比により相互干渉によるノイズのフィルタリングが行なわれる。

【0058】しかる後、ステップＳＴ１０で車両（物体）が検知されたかが判断され、ＹＥＳであればステップＳＴ１１ａで、例えば車両の有無を表示する表示ランプのリレーをオンにし、その表示ランプを点灯させる。車両が検知されない場合にはステップＳＴ１１ｂで表示ランプのリレーをオフとする。

【0059】

【発明の効果】以上説明したように、本発明によれば、複数の超音波センサを例えば駐車場の各駐車エリアごとに近接した状態で設置する場合において、各超音波センサの超音波発射間隔をそれぞれ不規則（ランダム）としたことにより、相互干渉による誤動作を大幅に低減することができる。

【0060】また、反射波データを順次記憶手段に記憶し、その各反射波データ同士を対比することにより、各反射波データが同一である場合には、それら反射波データを有効とし、非同一の場合には、他の超音波センサからの反射波が含まれていると判定することができる。

【図面の簡単な説明】

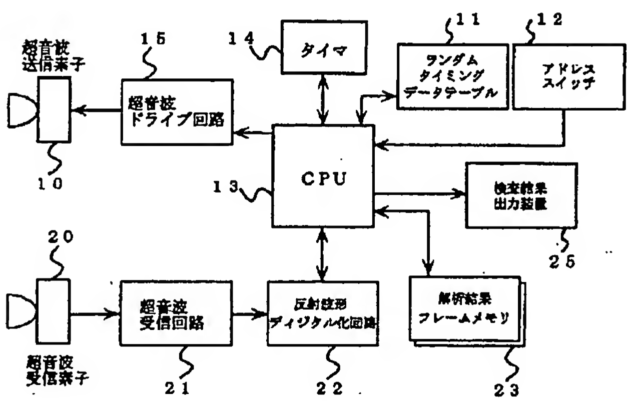
【図１】本発明に用いられる超音波センサの一実施例を示したブロック図。

【図２】上記超音波センサ内にあるランダムタイミング生成回路のデータテーブルを説明するための模式図。

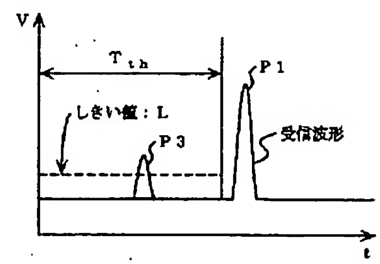
【図3】上記超音波センサにて受信した超音波波形を模式的に示した波形図。
【図4】本発明による超音波センサの超音波発射タインミグチャート。
【図5】上記超音波センサのフレームメモリに保存された反射波形を示したイメージ図。
【図6】上記超音波センサにて受信した超音波波形に対して設定されるしきい値を説明するための模式図。
【図7】本発明の別の実施例についての動作フローチャート。
【図8】上記別の実施例における超音波発射タインミグチャート。

【符号の説明】
10　超音波送信素子
11　ランダムタイミングデータテーブル
12　アドレススイッチ
13　CPU
14　タイマ
15　超音波ドライブ回路
20　超音波受信素子
21　超音波受信回路
22　反射波形ディジタル化回路
23　フレームメモリ

【図1】



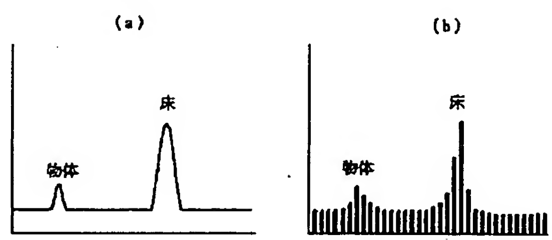
【図6】



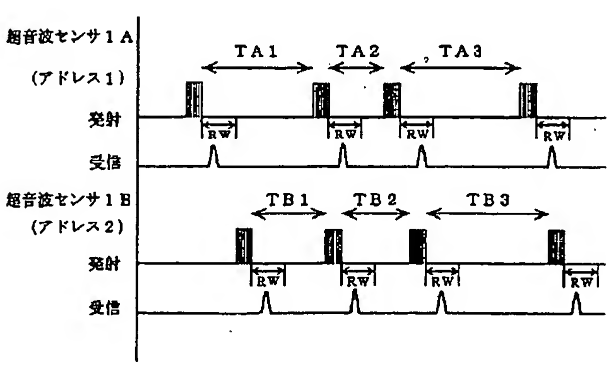
【図2】

T_1 ＼ アドレス	1回目	2回目	3回目	4回目	5回目	……
1	200	350	100	400	150	…
2	100	500	30	350	200	…
⋮	⋮	⋮	⋮	⋮	⋮	⋮

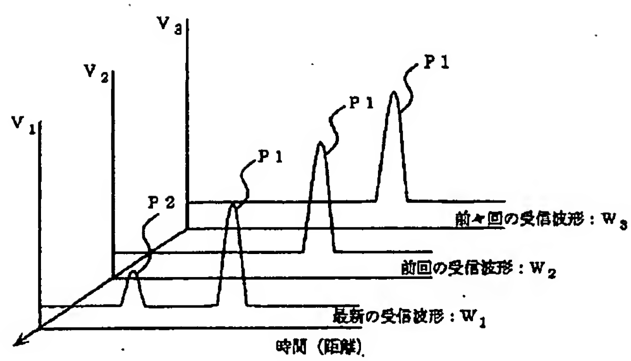
【図3】



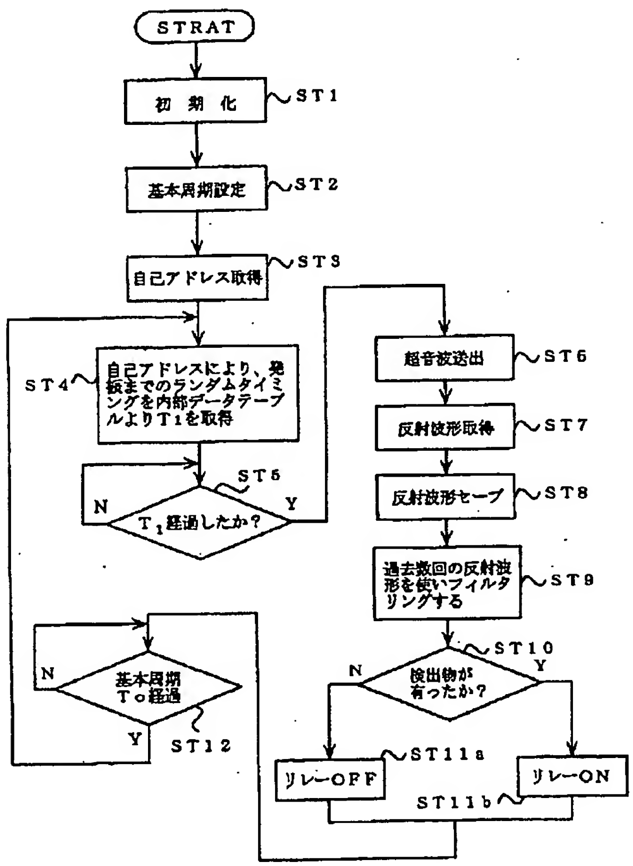
【図4】



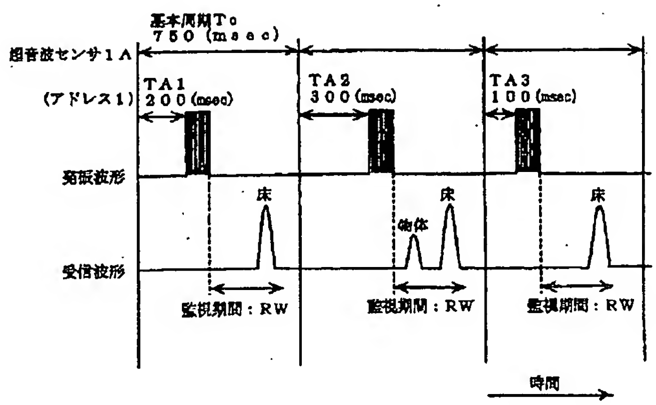
【図5】


V3
V2
V1
P1
P1
P1
P2
前々回の受信波形：W3
前回の受信波形：W2
最新の受信波形：W1
時間（距離）

【図7】


STRAT
初期化
ST1
基本周期設定
ST2
自己アドレス取得
ST3
自己アドレスにより、発振までのランダムタイミングを内部データテーブルよりT1を取得
ST4
T1経過したか？
ST5
N
Y
超音波送出
ST6
反射波形取得
ST7
反射波形セーブ
ST8
過去数回の反射波形を使いフィルタリングする
ST9
検出物が有ったか？
ST10
リレーOFF
ST11a
リレーON
ST11b
基本周期To経過
ST12

【図8】


基本周期To
750 (msec)
超音波センサ1A
TA1
(アドレス1)
200 (msec)
TA2
300 (msec)
TA3
100 (msec)
発振波形
床
物体
受信波形
監視期間：RW
監視期間：RW
監視期間：RW
時間

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the incorrect detection prevention approach of the ultrasonic sensor which prevents the incorrect detection by the mutual intervention of two or more ultrasonic sensors arranged in the neighborhood, if it says in more detail about the incorrect detection prevention approach of an ultrasonic sensor.
[0002]
[Description of the Prior Art] Although the ultrasonic sensor is used for various body detection sensors from the comparatively cheap thing, when applied, for example as a car detection sensor in a parking lot, it is arranged per each parking area at the head-lining part etc. That is, 1 area will be supervised by one sensor.
[0003] As mentioned above, since a supersonic wave is an elastic wave, when two or more ultrasonic sensors have been arranged in the neighborhood, distinction of whether to discharge from a neighboring sensor whether it is what the reflected wave discharged by self is difficult for it, and the problem of the incorrect detection by the mutual intervention produces it.
[0004] Although more various cures than before are taken in order to solve this problem, fundamentally, he is trying for those all to distinguish a self supersonic wave and the others' supersonic wave in time, and then they introduce those three examples.
[0005] From one ultrasonic sensor, a supersonic wave is fired for every time amount Ta second, on the other hand, as for the 1st approach, a supersonic wave is fired for every different time amount Tb second from it from ultrasonic sensor [of another side] B noting that two ultrasonic sensors approach and are arranged.
[0006] And if spacing of the reflected wave which received is in agreement in an ultrasonic sensor at the periodic Ta second which self transmitted on the other hand, it will be judged that it is what is depended on self transmission. If spacing of the reflected wave which received is in agreement similarly about the ultrasonic sensor of another side at the periodic Tb second which self transmitted, it will be judged that it is what is depended on self transmission.
[0007] The 2nd approach gives the periodic table of an ultrasonic discharge period to each ultrasonic sensor, and fires a supersonic wave according to the periodic table. And if receiving spacing of a reflected wave is in agreement with the periodic table, it will be judged that it transmits by self. In this approach, since distinction of oneself and others is further carried out more to clarification, once a reflected wave is at least able to check that it is what is depended on self transmission, a discharge periodic table may be changed.
[0008] As the 3rd approach, each neighboring ultrasonic sensor is connected by the synchronous line, and there is a method of making coincidence discharge a supersonic wave from each of that ultrasonic sensor. Thus, possibility that the supersonic wave from a neighboring sensor will be detected becomes low by making it discharge a supersonic wave all at once from all ultrasonic sensors.
[0009]
[Problem(s) to be Solved by the Invention] However, by the 1st approach, even if a means to verify in time whether ultrasonic discharge spacing and its reflected wave receiving spacing are

in agreement is indispensable and performs it hardware-wise or by software, complication will be caused as the whole system.
[0010] In the 2nd approach, when a neighboring sensor operates in the same period or the same periodic table, distinction of the oneself and others of a reflected wave becomes impossible. Moreover, since this period is generally directly related to the body detection speed of response of a sensor, it is not desirable to change a period in vain.
[0011] the 3rd approach operates each ultrasonic sensor to coincidence — sufficient — although it is the easiest in control, it is required among many ultrasonic sensors to take about a synchronous line, and difficulty follows on the construction. Moreover, by this approach, since the monitor period after an oscillation also becomes the same by all sensors, interference may occur depending on the location of the body which should be detected.
[0012] Without having been made in order that this invention might solve such many conventional problems, and the purpose connecting each ultrasonic sensor by a synchronous line etc., it is a software-based comparatively easy configuration also in hardware, and is in offering the incorrect detection prevention approach of the ultrasonic sensor which enabled it to prevent the mutual intervention between each ultrasonic sensor.
[0013]
[Means for Solving the Problem] In the incorrect detection prevention approach of the ultrasonic sensor which prevents the incorrect detection by the mutual intervention of two or more ultrasonic sensors by which this invention has been arranged in the neighborhood in order to attain the above-mentioned purpose A supersonic wave is repeatedly discharged towards a monitor field from the ultrasonic transmitting component of each above-mentioned ultrasonic sensor. While making the ultrasonic discharge spacing irregular for every above-mentioned ultrasonic sensor in receiving the reflected wave which appears within a predetermined monitor period from the ultrasonic discharge point in time with an ultrasonic receiving component each time The sequential storage of the reflected wave received within the above-mentioned monitor period is carried out at a storage means, and it is characterized by detecting the existence of the body in the above-mentioned monitor field based on two or more reflected wave data memorized by this storage means.
[0014] Thus, since a reflected wave monitor period also becomes irregular irregularity, i.e., by supposing that it is random, according to this about the ultrasonic discharge spacing for every ultrasonic sensor, the probability to receive the supersonic wave from other ultrasonic sensors continuously within the reflected wave monitor period becomes very low.
[0015] Even if it received the supersonic wave from other ultrasonic sensors within the reflected wave monitor period, since he is trying to detect objective existence not only including the reflected wave data received this time but the reflected wave data received in the past, such as the last time and second from last time, for example, a mutual intervention can be eliminated by this invention.
[0016] That is, ultrasonic discharge timing will measure the reflected wave from the reflective object (quiescence body) which should be detected essentially from the discharge time of day in any condition, and it will appear in the same time location. Therefore, in detecting the existence of the body in a monitor field based on two or more reflected wave data within a storage means, when each reflected wave data is the same, these reflected wave data can be confirmed, and it can judge with the reflected wave from other ultrasonic sensors being contained in the case of nonidentity.
[0017] In that case, it can judge simply and correctly whether the reflected wave from other ultrasonic sensors is contained by setting, using a storage means as a frame memory, saving each reflected wave data as a reflected wave form at this frame memory, and contrasting the reflected wave forms.
[0018] In this invention, it has the random timing generation means which makes the ultrasonic discharge spacing irregular for every ultrasonic sensor. The timetable which has irregularity ultrasonic discharge spacing covering the multiple times set to this random timing generation means corresponding to the address assigned to each ultrasonic sensor and its address is prepared. The different address for every ultrasonic sensor will be set up, and each ultrasonic

sensor will repeat an irregular oscillation which is different based on the set-up self-address, respectively by this.
[0019] Moreover, it is desirable to make the primitive period of each ultrasonic sensor the same, and to make ultrasonic discharge spacing irregular into the primitive period, and according to this, the body detection speed of response of each ultrasonic sensor can be held down in dispersion in extent which is not made into a precision top problem.
[0020]
[Embodiment of the Invention] Next, when you understand the technical thought of this invention better, the example is explained, referring to a drawing.
[0021] When drawing 1 is the block diagram of the ultrasonic sensor 1 used by this invention and the application is the car detection sensor of a parking lot, the ultrasonic sensor 1 of the same configuration as this will be formed for every parking area of that, respectively.
[0022] This ultrasonic sensor 1 is divided into the transmitting system containing the ultrasonic transmitting component 10 of explanation, and the receiving system containing the ultrasonic receiving component 20 for convenience.
[0023] The random timing data table 11 for firing a supersonic wave is prepared for the irregular target (random) from the ultrasonic transmitting component 10 at the transmitting system. The data table as shown in drawing 2 is beforehand set to this random timing data table 11.
[0024] That is, this data table takes the address number 1 of a predetermined number, and 2 — to left column ****, it is the timetable which made the horizontal train the order (the 1st time, the 2nd time, 3rd time —) of the count of ultrasonic discharge, and the data of whether to fire a supersonic wave in what mm second from the time of discharge (or base period) last time along with the order of the count of ultrasonic discharge for every address number of that are written in.
[0025] This ultrasonic discharge time data is data which have regularity between the addresses and in neither of the order of the count of ultrasonic discharge, and it is [in / this semantics] desirable to set up using a random number.
[0026] The address of this data table is suitably chosen by the user through the address switch 12 prepared in each ultrasonic sensor 1. That is, if the self address is set as the address 1 by the address switch 12, with a central processing unit (CPU) 13, the timetable of the address 1 will be read and it will be set to a timer 14.
[0027] According to this timetable, since the 1st oscillation timing is 200 mses, let the latency time until it oscillates be 200 mses. The 2nd oscillation latency time is 350 mses, and after doing in this way and oscillating n times, it returns to the 1st oscillation timing.
[0028] Thus, the ultrasonic discharge time data read by CPU13 is given to the ultrasonic drive circuit 15, and the ultrasonic transmitting component 10 drives it according to the timing.
[0029] In a receiving system, the reflected wave received with the ultrasonic receiving component 20 is given to the reflected wave form digitization circuit 22 through the reflected wave receiving circuit 21. In this example, the reflected wave form digitization circuit 22 has a detector circuit and an A/D-conversion circuit, for example, acquires a detection wave like drawing 3 (a) from a reflected wave in that detector circuit, then carries out A/D conversion of this detection wave, and makes it a digital reflected wave form as shown in this drawing (b).
[0030] Incidentally, in the detection wave of drawing 3 (a), although a right-hand side big peak wave is a thing from a floor line, a left-hand side small peak wave is based on either a detection body (this example car) or a mutual intervention. In addition, a comparator is used instead of an A/D-conversion circuit, and you may make it extract a reflected wave form for the detection wave of a reflected wave as ON and off digital information with a suitable threshold.
[0031] As mentioned above, the reflected wave form by which A/D conversion was carried out in the reflected wave form digitization circuit 22 is saved at a frame memory 23 (save). In this case, after ultrasonic discharge directing to the transmitting system according [digitization of the monitor period timing of the reflected wave which can be set a receiving system, i.e., a reflected wave form,] to CPU13, that activation is directed using a timer 14, and thereby, the time-axis length of a reflected wave is controlled uniformly.
[0032] That is, digitization of a reflected wave form is performed with a transmitting system and

a fixed synchronization, and termination of digitization processing is also controlled uniformly in time. Thus, whenever a supersonic wave is discharged from the ultrasonic transmitting component 10, a reflected wave form can be acquired by making fixed time amount into a reflected wave monitor period from the discharge time.
[0033] To drawing 4, the relation of the ultrasonic discharge timing and the reflected wave monitor period of two ultrasonic sensors 1A and 1B by which contiguity arrangement was carried out is illustrated. As shown in this drawing, the ultrasonic discharge spacing TA1 and TA2 of one ultrasonic sensor 1A and TA3 — are based on the address number 1 of the data table of drawing 2, and the ultrasonic discharge spacing TB1 and TB2 of ultrasonic sensor 1B of another side and TB3 — are based on the address number 2 of this data table, and although the discharge spacing is random respectively, it sets the reflected wave monitor period RW always constant.
[0034] Moreover, the writing of the reflected wave data to a frame memory 23 is also performed by CPU13. Namely, CPU13 is saved one by one as mentioned above at a frame memory 23 by using as one-frame data the reflected wave form digitized with the transmitting system and the fixed synchronization. Thus, the reflected wave form covering multiple times is saved.
[0035] In this invention, it judges whether the reflected wave by the mutual intervention is contained in it based on the reflected wave form saved to the frame memory 23. What is necessary is preparing a frame memory analysis circuit etc. separately and making it just make frame memory data calculate in this example, although that judgment function is given to CPU13, when processing this in hardware.
[0036] Drawing 5 is the image Fig. of the reflected wave form of past 3 batch saved at the frame memory 23. In addition, in this example, although a reflected wave form is originally a digital wave, it is shown as the expedient top of explanation, and an analog wave.
[0037] In the analysis of a frame memory, those waves compare the reflected wave form W1 of this past 3 batch, i.e., the newest (this time) received reflected wave form, the last received reflected wave form W2, and received reflected wave form W3 before last, for example.
[0038] In this example, reflective peak wave P1 is a thing from a floor line, and each reflected wave form W1 - W3 have appeared in the same location. On the other hand, reflective peak wave P2 [another] have appeared in the newest received reflected wave form W1 on the left-hand side of reflective peak wave P1.
[0039] Although reflective peak wave P2 should appear in the same location also as the last received reflected wave form W2 and received reflected wave form W3 before last since ultrasonic discharge spacing is a ms unit if based on bodies which do not move, such as a car which these reflective peak wave P2 have parked, in this example, it does not exist in the reflected wave form W2 and W3.
[0040] Therefore, in such a case, it is judged that reflective peak wave P2 have high possibility of being based on a mutual intervention. In addition, although this example is comparing the reflected wave form of past 3 batch, this is a kind of filter actuation, and the number of the reflected wave forms made applicable [for analyzing] to a comparison is arbitrary.
[0041] Moreover, in order to cover a filter over the reflected wave form by the mutual intervention as mentioned above, approaches, such as taking the wave-AND between each reflected wave form, or taking averaging, can be illustrated.
[0042] On the other hand, if it says in the example of drawing 5 when a car exists in parking area, as shown in all each reflected wave forms W1 - W3 at drawing 6, reflective peak wave P3 by the parking car will appear in the left-hand side with reflective peak wave P1 from a floor line. Here, left-hand side is that a reflected wave comes back early in time than a floor line, and means that a reflective object is between a floor line and a sensor.
[0043] Thus, detection of a body gives the result to an output circuit 25. This output circuit 25 may be the relay and LED (light emitting diode) which were carried in the ultrasonic sensor.
[0044] Although these reflective peak wave P3 are detected by relation for example, with threshold level L, that threshold level L will be suitably set up on the basis of the reflection from the head-lining side of a car etc. in this case.
[0045] Since reflective peak wave P3 are what is depended on reflection from a place higher than a floor line, i.e., the place near a sensor, they reach the ultrasonic receiving component 20

quickly rather than reflective peak wave P1 from a floor line in time.
[0046] the case where, as for the existence of a detection body, a reflected wave exceeds threshold level L fundamentally -- "-- it is -- " -- the case where it does not exceed is judged to be "nothing." Therefore, in order not to use reflective peak wave P1 from a floor line as a detection object, this example has canceled the threshold by the predetermined time amount width of face Tth as shown in drawing 6 .
[0047] Next, a primitive period is set as each ultrasonic sensor 1, as another example, the case where a supersonic wave is fired at random within the primitive period is added, and the timing chart of the operation flow chart of drawing 7 and dispatch of drawing 8 , and reception is explained for it in more detail.
[0048] First, after initialization of the control system of this ultrasonic sensor 1 that contains CPU13 in a step ST 1 is performed, a primitive period TO is set up by CPU13 at a step ST 2. In this example, a primitive period TO is set as 750 mses, and a supersonic wave is surely discharged once within this primitive period TO.
[0049] This primitive period TO is set up in common about all the ultrasonic sensors 1, and, thereby, detection time until it results in that reflected wave reception, filtering actuation, and body detection is secured from the ultrasonic oscillation of an ultrasonic sensor 1.
[0050] Next, in a step ST 3, CPU13 obtains the self-address set up by the user from an address switch 12. In addition, in relation with the ultrasonic sensor installed in the neighborhood, assignment of this self-address is beforehand set up by the user so that ultrasonic discharge timing may differ.
[0051] Thus, if the self-address is specified, in a step ST 4, each ultrasonic sensor 1 will read the ultrasonic discharge latency-time data set up in order of the count of ultrasonic discharge from the timetable belonging to the address number, and will discharge a supersonic wave from the ultrasonic transmitting component 10 based on the data.
[0052] Ultrasonic sensor 1A is explained as a representative, referring to the data table of drawing 2 , and the timing chart of drawing 8 for this actuation. Supposing ultrasonic sensor 1A acquires the address number 1 from an address switch 12, in a step ST 4, 200 mses will be first obtained as 1st discharge timing data TA 1.
[0053] After waiting until 200 mses pass from the first stage point in time of a primitive period TO at a step ST 5, a supersonic wave is sent out at a step ST 6. That is, a supersonic wave is discharged [from the head of the Maine processing] towards monitor area from the ultrasonic transmitting component 10 after 200 mses.
[0054] And the reflected wave from monitor area is received at a step ST 7, and after acquiring a reflected wave form in the reflected wave form digitization circuit 22, the reflected wave form is saved at a step ST 8 at a frame memory 23.
[0055] Then, at a step ST 9, by past several contrast with a reflected wave form, although the noise by the mutual intervention is filtered, after waiting until it jumps a step ST 10 and a step ST 11 since the count of discharge of a supersonic wave is the 1st time, and TO time amount which is a primitive period at a step ST 12 passes in this case, it returns to a step ST 4. By waiting for this primitive period TO time amount, the response speed of an ultrasonic sensor can be dedicated in a fixed error.
[0056] And 350 mses are obtained from a data table as 2nd discharge timing data TA 2 at a step ST 4. Then, a supersonic wave is discharged after 350 mses from the head of the Maine processing this time. Thus, sequential discharge of the supersonic wave is carried out by discharge timing TA 1 which is different from the first stage point in time of each primitive period TO towards monitor area from the ultrasonic transmitting component 10, and TA2 --.
[0057] Thereby, each of that reflected wave form is saved for the ultrasonic discharge of every at a frame memory 23, and filtering of the noise by the mutual intervention is performed at a step ST 9 in 2nd henceforth by the past several contrast with a reflected wave form.
[0058] It is judged whether the car (body) was detected at a step ST 10 after an appropriate time, a relay of the display lamp which is step ST11a if it is YES, for example, displays the existence of a car is turned ON, and the display lamp is made to turn on. When a car is not detected, a relay of a display lamp is made off by step ST11b.

[0059]
[Effect of the Invention] As explained above, when installing two or more ultrasonic sensors in the condition of having approached for every parking area of a parking lot, according to this invention, malfunction by the mutual intervention can be sharply reduced by having made ultrasonic discharge spacing of each ultrasonic sensor into irregularity (random), respectively.
[0060] Moreover, by memorizing reflected wave data for a sequential storage means, and contrasting each of those reflected wave data, when each reflected wave data is the same, these reflected wave data can be confirmed and, in the case of nonidentity, it can judge with the reflected wave from other ultrasonic sensors being contained.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In the incorrect detection prevention approach of the ultrasonic sensor which prevents the incorrect detection by the mutual intervention of two or more ultrasonic sensors arranged in the neighborhood A supersonic wave is repeatedly discharged towards a monitor field from the ultrasonic transmitting component of each above-mentioned ultrasonic sensor. While making the ultrasonic discharge spacing irregular for every above-mentioned ultrasonic sensor in receiving the reflected wave which appears within a predetermined monitor period from the ultrasonic discharge point in time with an ultrasonic receiving component each time The incorrect detection prevention approach of the ultrasonic sensor which carries out the sequential storage of the reflected wave received within the above-mentioned monitor period at a storage means, and is characterized by detecting the existence of the body in the above-mentioned monitor field based on two or more reflected wave data memorized by this storage means.
[Claim 2] The incorrect detection prevention approach of the ultrasonic sensor according to claim 1 which in detecting the existence of the body in the above-mentioned monitor field based on two or more reflected wave data within the above-mentioned storage means confirms these reflected wave data when each reflected wave data is the same, and is characterized by judging with the reflected wave from other ultrasonic sensors being contained in the case of nonidentity.

[Claim 3] It is the incorrect detection prevention approach of the ultrasonic sensor according to claim 2 characterized by judging whether the above-mentioned reflected wave data are saved as a wave at this frame memory, and the reflected wave from other ultrasonic sensors is contained by contrast of the waves while the above-mentioned storage means consists of a frame memory.

[Claim 4] The incorrect detection prevention approach of the ultrasonic sensor according to claim 1 or 2 characterized by to have the random timing generation means which makes the ultrasonic discharge spacing irregular for every above-mentioned ultrasonic sensor, and for the address assigned to each above-mentioned ultrasonic sensor and the timetable which has irregularity ultrasonic discharge spacing data covering the multiple times set up corresponding to the address to be prepared in this random timing generation means, and to be controlled ultrasonic discharge spacing based on this timetable.
[Claim 5] The primitive period of each above-mentioned ultrasonic sensor is the incorrect detection prevention approach of the ultrasonic sensor according to claim 1, 2, or 4 characterized by supposing that it is the same and supposing that ultrasonic discharge spacing is irregular into the primitive period.

[Translation done.]

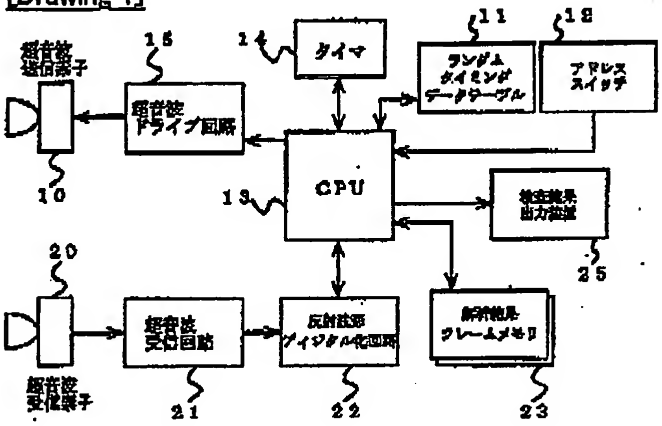
DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The block diagram having shown one example of the ultrasonic sensor used for this invention.
[Drawing 2] The mimetic diagram for explaining the data table of the random timing generation circuit in the above-mentioned ultrasonic sensor.
[Drawing 3] The wave form chart having shown typically the ultrasonic wave received with the above-mentioned ultrasonic sensor.
[Drawing 4] The ultrasonic discharge TAIN MIG chart of the ultrasonic sensor by this invention.
[Drawing 5] The image Fig. having shown the reflected wave form saved at the frame memory of the above-mentioned ultrasonic sensor.
[Drawing 6] The mimetic diagram for explaining the threshold set up to the ultrasonic wave received with the above-mentioned ultrasonic sensor.
[Drawing 7] The operation flow chart about another example of this invention.
[Drawing 8] The ultrasonic discharge TAIN MIG chart in the example according to above.
[Description of Notations]
10 Ultrasonic Transmitting Component
11 Random Timing Data Table
12 Address Switch
13 CPU
14 Timer
15 Ultrasonic Drive Circuit
20 Ultrasonic Receiving Component
21 Ultrasonic Receiving Circuit
22 Reflected Wave Form Digitization Circuit
23 Frame Memory

[Translation done.]

DRAWINGS

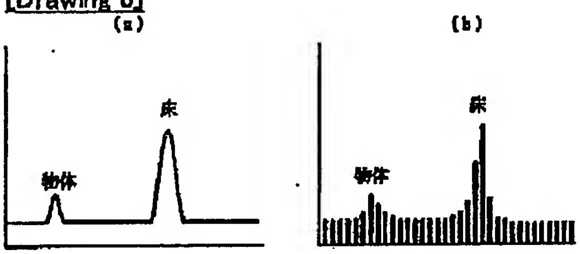
[Drawing 1]



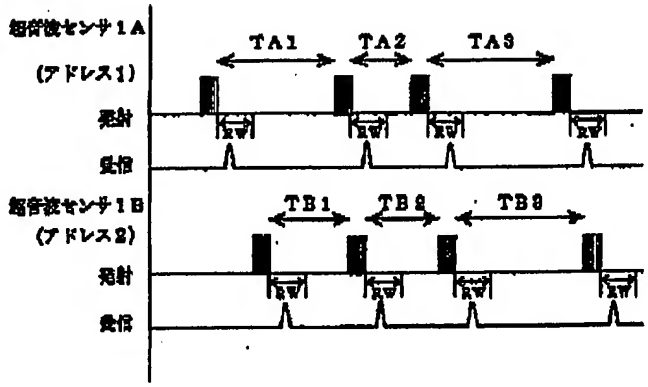
[Drawing 2]

アドレス \ Ti	1回目	2回目	3回目	4回目	5回目	·····
1	200	850	100	400	150	···
2	100	600	30	350	200	···
⋮	⋮	⋮	⋮	⋮	⋮	⋮

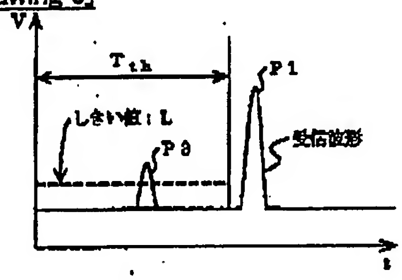
[Drawing 3]



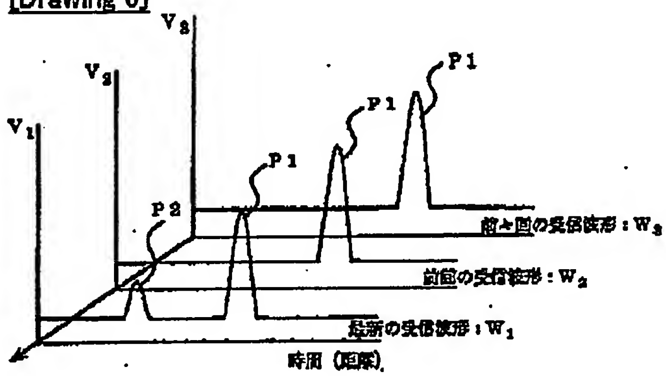
[Drawing 4]



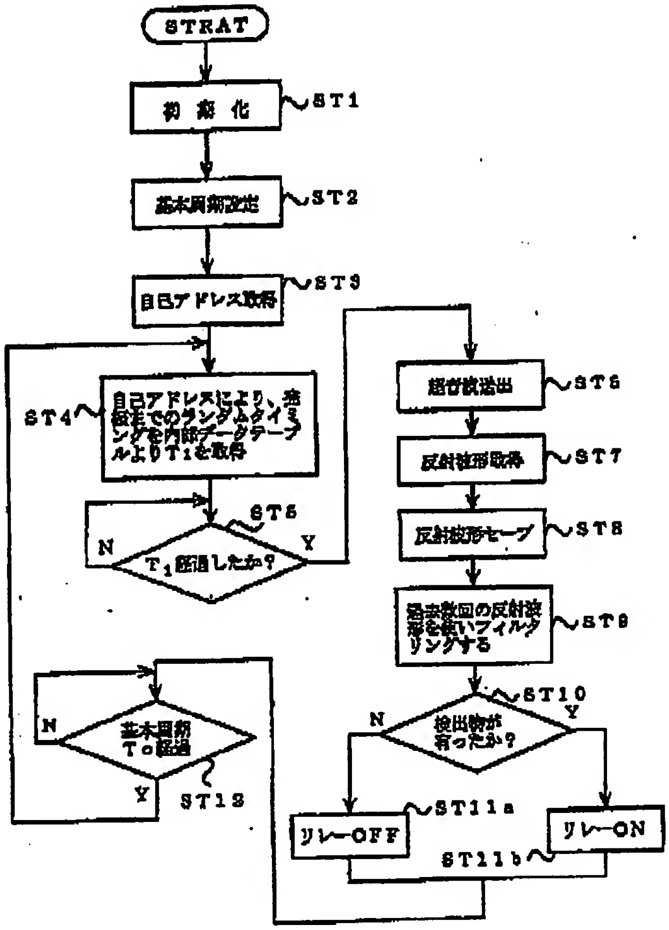
[Drawing 6]



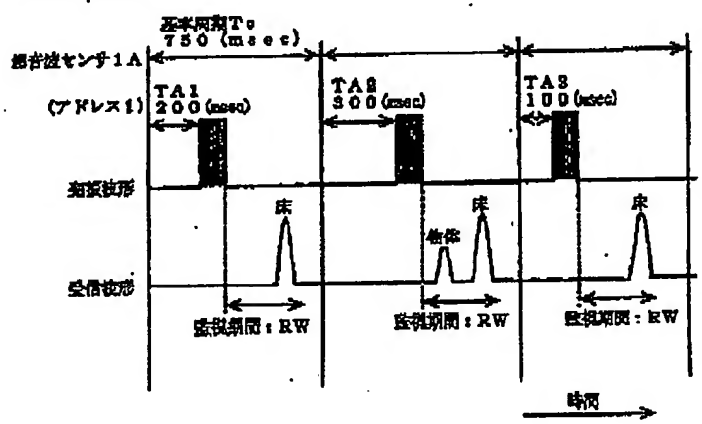
[Drawing 5]



[Drawing 7]



[Drawing 8]



[Translation done.]

APPENDIX C – RELATED PROCEEDINGS

NONE

$ AF IFW

PTO/SB/17 (12-04v2)
Approved for use through 7/31/2006. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 500.00

Complete if Known	
Application Number	10/625,654-Conf. #8902
Filing Date	July 24, 2003
First Named Inventor	Masanobu Okada
Examiner Name	K. C. Koyama
Art Unit	2876
Attorney Docket No.	O3020.0342/P342

METHOD OF PAYMENT (check all that apply)

☐ Check ☒ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ____

☒ Deposit Account Deposit Account Number: 04-1073 Deposit Account Name: Dickstein Shapiro Morin & Oshinsky LLP

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☒ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fee ($)	Small Entity Fee ($)	Fees Paid ($)
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee ($)	Small Entity Fee ($)
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims: 9 - 20 = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

Indep. Claims: 5 - 5 = Extra Claims ____ x Fee ($) ____ = Fee Paid ($) ____

Multiple Dependent Claims: Fee ($) ____ Fee Paid ($) ____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = Extra Sheets ____ /50 = Number of each additional 50 or fraction thereof ____ (round **up** to a whole number) x Fee ($) ____ = Fee Paid ($) ____

4. OTHER FEE(S) Fees Paid ($)

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): 1402 Filing a brief in support of an appeal 500.00

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